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(54) **MOVABLE AERIAL**

DREHBARE ANTENNE

ANTENNE MOBILE

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(56) References cited:
EP-A- 0 395 928
US-A- 4 866 456

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Description

This invention relates to movable aerials, and particularly to aerials movable from horizon to horizon. Such aerials are frequently parabolic dish aerials intended to be aligned with geostationary or movable signal sources or sinks to improve the strength of signal received. Although the invention is primarily applicable to aerials for receiving signals, it could be applied to transmission aerials, particularly microwave aerials, to point them accurately at a movable reception aerial.

FR-A-2 247 829 discloses an aerial intended to be aimed at a geostationary satellite. It comprises a fixed pyramidal support for an aerial dish coupled at three points to the support. The upper coupling is a ball joint, while the two lower couplings are of adjustable length to enable the axis of the dish to be adjusted through a relatively-narrow range of angles dictated by the mechanical constraints of the support.

FR-A-2 505 560 also discloses an aerial of restricted movement intended to be aimed at a geostationary satellite. A dish support is connected at one end to the ground by a ball coupling, and has its other end connected to the outer end of a jack of adjustable length movable in an upright plane about a fixed pivot. The dish support is itself pivotable about its axis under the control of a second jack pivotable about a ground connection.

In neither case is the dish steerable through an angle of about 180°, so that neither known aerial can be used for following a signal source from one horizon to the opposite one.

From EP-A-0 395 928 there is known a movable aerial according to the preamble of Claim 1. Moreover, from US-A-4 866 456 there is known a dish antenna being steerable through an angle of about 180°.

The present invention aims at providing a movable horizon-to-horizon aerial which does not suffer from these disadvantages, and accordingly provides an aerial as claimed in the appended claims.

The present invention will now be described by way of example with reference to the accompanying drawings, in which:

Figure 1	is a side view of one embodiment of a movable aerial of the present invention;
Figure 2	is a plan view of the aerial shown in Figure 1;
Figure 3	is a diagrammatic view showing the aerial support and its associated jack attachment arms in their central position, and
Figure 4 and 5	are views similar to Figure 3, showing the aerial supports when the aerial is pointing at opposite horizons.

As shown in Figures 1 and 2, a dish 2 for the receipt of microwave signals is coupled through the apparatus of the present invention to a vertical support, in this case in the form of a post 4 extending vertically from its base (not shown). Clamped to the upper end of the post 4, by means of U-shaped clamps 6 having screw-threaded ends on which work clamping nuts 8, is a support 10. Pivoted on this support is a carrier 12 pivotable through 90° about the axis of a rod 14. Extending from carrier 12 is a screw-threaded stub shaft which extends through an arcuate slot 16 in support 10, and which has a lock nut 18 working on it so that after the lock nut has been loosened on its shaft, the carrier 12 may be pivoted about rod 14 to any desired angular extent before being locked in position by means of nut 18.

The carrier 12 has two parallel plates 20 extending from it and carrying a rotary shaft 22 having an arm 24 secured to it at one end, and a like arm 26 at the other end. The arms 24 and 26 have their axes lying in a common plane, but extend in opposite directions, so that the shaft 22 and its arms 24 and 26 form a Z-shaped lever.

Arm 24 terminates in a plate 28 coupled through a rotary joint to a tube clamp 30 which embraces one end of the cylinder 32 of an hydraulic or motor-driven jack 34.

In similar fashion, the outer end of arm 26 is connected to the outer end of a piston 36 of a second jack 38 by a coupling 40 permitting a limited degree of universal motion. In the case of jack 38, the cylinder of the jack is embraced by a clamp 42 which is secured in a pivotable fashion to support 10 by means of a connector 44.

Also pivoted on shaft 22 is a dish support 46 having a pair of parallel plates 48 journalled on shaft 22. The dish support 46 has a secondary support 50 secured to it for limited rotational movement about the axis of a support rod 52. The angle through which the secondary support 50 is free to move is dictated by the movement of a stub shaft projecting from carrier 46 through an arcuate slot 54 in support 50, and held in position by a clamp nut 56 working on the stub shaft.

It can be seen from Figure 1 that the outer end of the piston 58 of jack 34 is connected to secondary support 50 through a ball coupling 60 permitting a limited amount of universal movement. In practice, the aerial dish 2, together with any of its associated components, is clamped to secondary support 50 in a way which does not form part of the subject-matter of this invention, and therefore which will not be described herein in any greater detail.

Because of the construction shown in Figure 1, it will be appreciated that the support 12 may be pivoted about rod 14 so that the axis of aerial 2 is able to point at any fixed angle between the zenith and the horizon. In practice, the angle would be chosen so that the axis of the aerial intercepts the locus of a movable satellite or an ecliptic plane containing a particular geostationary

satellite.

In the accompanying drawings, those components which are the same in different drawings retain their same references.

From Figure 2 of the drawings it will be appreciated how the two jacks 34 and 38 have their lines of action positioned on opposite sides of post 4.

When jack 38 is operated in either sense, that is to shorten or lengthen it, the distance between clamp 42 and the outer end of arm 26 is altered. If the jack 34 is not actuated at this time, then the resultant angular movement of arm 26 about the axis of shaft 22 results in pivotal movement of support 46 about the axis of shaft 22. This is because the portion of the jack 34 extending between the clamp 30 and the coupling 60 acts as a strut or tie.

In like fashion, when jack 34 is actuated, with jack 38 not actuated, the resultant pivotal movement of dish 2 about the axis of shaft 22 is dictated by the change in length of the effective portion of jack 34.

From the central position shown in Figures 1 and 2, and as indicated diagrammatically in Figure 3, it can be seen that the maximum extension of jack 34 alone is able to cause the aerial 2 to pivot by about 45° about shaft 22. The same applies when jack 34 is retracted to its position of minimum length, with the resultant pivotal movement of dish 2 being in the opposite direction. When jack 38 is likewise extended to its maximum length, this results in pivotal movement of arms 24 and 26 by about 45°. Thus when the maximum extension of jack 38 is combined with the maximum retraction of jack 34, the combined result is pivotal movement of aerial 2 through nearly 90° from that shown in Figure 2. This is the position diagrammatically indicated in Figure 4 of the accompanying drawings.

Conversely, when jack 38 is retracted to its minimum length, and jack 34 extended to its maximum length, the result is rotation of the dish 2 through about 90° from the position shown in Figures 1 and 2. This is reflected in Figure 5 of the drawings.

By 'jack' in this specification is meant any device of controllable length which is able to act as a strut or tie able to withstand the mechanical forces exerted on it in use. The jacks may operate on the ball-and-rack principle; in the manner of a rack and pinion, or each may be in the form of a hydraulic cylinder having an axially-movable ram. For convenience of description, whatever the mechanical form of the jack, it has been found convenient to call the relatively-stationary member the cylinder, and to call the relatively-movable member the piston, irrespective of the actual construction of the jack. As has already been stated or implied, each motor driving its jack is able to control the effective length of its jack by applying sufficient force to move the aerial, and to resist high winds or other forces tending to move the aerial from a set position. The two jacks may be operated in unison to bring about a rapid change in the position of the aerial, or they may be energised in sequence. Jack 34 is intended to be actuated in known fashion by a DC motor 62, and jack 38 by motor 64.

In conventional fashion, the aerial 2 may support a detector (not shown) for the microwave or other radiation being received. The detector is coupled by means of a flexible cable to appropriate amplifiers and display apparatus for using the signal. As the nature of the equipment which processes the incoming signals does not form part of the subject-matter of this invention, it will not be discussed herein in any further detail.

The motors driving the jacks are connected through flexible cables to a control device powered by a source of direct voltage. This is because the motors would usually be DC motors of which the polarity can be reversed to obtain movement in the opposite direction. It will be appreciated that if AC motors are used, for whatever reason, the control apparatus and energy supply would need to be different, but as these do not form part of the subject-matter of this invention, they will not be described herein in any further detail. In all cases, the nature and paths of the flexible cables are such that they are able to absorb all the movement of the aerial and its support without impeding such movement or being in any way affected by it.

When the two jacks 34 and 38 are not intended to be driven in unison, but only sequentially, it can be arranged that initially only one of the jacks is driven. When this jack reaches its limit of movement, and the aerial has not yet attained its desired position, a limit switch on the jack support may be closed by movement of the jack to enable electric current or other energy to be supplied to the second jack to move the aerial to its desired position. Although it is envisaged that usually the two jacks would be of the same type as each other, and having the same characteristics, it is within the purview of the present invention, in the case of the differential operation thereof just described, to use jacks of differing type and/or characteristics, so that each jack is operated within its preferred envelope of operation in order to do its share in the movement of the aerial.

Although jack 34 has been described as having its cylinder 32 gripped by clamp 30, and its piston pivotally coupled to the aerial support 50, the orientation of the jack could of course be reversed, with its cylinder being pivotally secured to the aerial, and with its piston being pivotally connected to the end of arm 24. In like manner, the jack 38 could have its cylinder pivotally connected to the end of lever 26, and its piston pivotally connected to the coupling 42. Orientating one or both jacks in manner opposite to their orientations as shown in the drawings would have the same mechanical effect, in that it is the effective changes of length of the respective jacks which bring about the desired angular movement of aerial 2. Other considerations would usually be applied to dictate the actual orientation of the respective jack in different embodiments of the invention.

It will be seen that the present invention provides a relatively-simple manner of mounting and moving an

aerial so that it is able to sweep controllably through an arc of about 180°.

Claims

1. A movable aerial comprising a dish (2) free to pivot about the axis of a shaft (22) extending in a desired direction, and a remotely-operable jack (34) as herein defined having its body or ram attached to a support (62), and having its ram or body attached to an aerial support for pivotal movement of the aerial about the shaft axis,

   characterised by a second remotely-operable jack (38) able to have its movements added to, or subtracted from, those movements attributable to the first jack (34), so that the angular movement of the aerial in its plane of movement is the sum of the movements arising from both jacks (34, 38).

2. An aerial as claimed in claim 1, in which the dish is movable with a cylindrical sleeve (10, 12) mounted for rotary movement on a shaft extending between trunnions secured to the support.

3. An aerial as claimed in claim 2, in which the sleeve has arms which extend normally to the axis of the shaft, from opposite ends thereof and in opposite directions, with their longitudinal axes lying in the same plane.

4. An aerial as claimed in Claim 2 or 3, in which each jack is pivotable about its connection to the sleeve so as to accommodate the angular movements of the dish.

5. An aerial as claimed in any preceding claim, in which the body of each jack is embraced by a collar which is pivotally secured to the respective end of its support, with one ram extending from the aerial support to one end of a pivotable lever (22, 24, 26), and with the other ram extending from another end of the lever to a collar having a virtually-fixed pivotal axis.

6. An aerial as claimed in any preceding claim, including a limit switch associated with one jack, whereby when the jack reaches one of its limit positions, the switch is operated to cause the other jack to be operated to complete the necessary further movement required of the dish.

7. An aerial as claimed in any preceding claim, having a mount adapted to be secured to a stationary support, and in which the aerial support is movable about an axis which extends perpendicularly to the axis about which the aerial is movable.

Patentansprüche

1. Eine verschwenkbare Antenne, die eine Schüssel (2), die frei ist, sich um die Achse eines Schafts (22) zu verschwenken, der sich in eine erwünschte Richtung erstreckt, und einen fernsteuerbaren Linearantrieb (jack) (34) umfaßt, wie er hier definiert ist und dessen Körper oder Stempel an einer Stütze (62) befestigt ist und dessen Stempel oder Körper an einer Antennenhalterung zur Schwenkbewegung der Antenne um die Schaftachse herum befestigt ist,
   gekennzeichnet durch einen zweiten, fernsteuerbaren Linearbetrieb (jack) (38) dessen Bewegungen zu jenen Bewegungen addierbar oder von jenen subtrahierbar sind, die dem ersten Linearantrieb (34) zuzuordnen sind, so daß die Winkelbewegung der Antenne in ihrer Bewegungsebene die Summe der Bewegungen ist, die sich aus den beiden Linearantrieben (34, 38) ergeben.

2. Eine Antenne, wie in Anspruch 1 beansprucht, in der die Schüssel mit einer zylindrischen Hülse (10, 12) bewegbar ist, die zur Drehbewegung auf einem Schaft angebracht ist, der sich zwischen Drehzapfen erstreckt, die an der Halterung befestigt sind.

3. Eine Antenne, wie in Anspruch 2 beansprucht, in der die Hülse Arme hat, die sich normal zu der Achse des Schafts von gegenüberstehenden Enden davon und in entgegengesetzte Richtungen erstrecken, wobei ihre Längsachsen in derselben Ebene liegen.

4. Eine Antenne, wie in Anspruch 2 oder 3 beansprucht, in der jeder Linearantrieb um seine Verbindung mit der Hülse verschwenkbar ist, um die Winkelbewegungen der Schüssel aufzunehmen.

5. Eine Antenne, wie in irgendeinem vorhergehenden Anspruch beansprucht, in der der Körper von jedem Linearantrieb von einem Kragen umfaßt ist, der verschwenkbar an dem jeweiligen Ende seiner Halterung befestigt ist, wobei sich ein Stempel von der Antennenhalterung zu einem Ende eines verschwenkbaren Hebels (22, 24, 26) erstreckt und sich der andere Stempel von dem anderen Ende des Hebels zu einem Kragen erstreckt, der eine virtuell festgelegte Schwenkachse aufweist.

6. Eine Antenne, wie in irgendeinem vorhergehenden Anspruch beansprucht, die einen Endschalter einschließt, der mit einem Linearantrieb verbunden ist, wodurch, wenn der Linearantrieb eine seiner Endposition erreicht, der Schalter betätigt wird, um zu bewirken, daß der andere Linearantrieb betrieben wird, um die notwendige weitere Bewegung zu vervollständigen, die von der Schüssel verlangt wird.

7. Eine Antenne, wie in irgendeinem vorhergehenden Anspruch beansprucht, die eine Befestigung hat, die an einer ortsfesten Stütze befestigt werden kann, und in der die Antennenhalterung um eine Achse bewegbar ist, die sich senkrecht zu der Achse erstreckt, um die die Antenne bewegbar ist.

Revendications

1. Antenne orientable comprenant un réflecteur d'antenne (2) pouvant pivoter autour de l'axe d'un arbre (22) s'étendant dans une direction désirée, et un vérin (34), tel que défini ici, pouvant être commandé à distance, ayant son corps ou sa tige fixé(e) à un support (62), et ayant sa tige ou son corps fixé(e) à un support d'antenne afin de permettre le mouvement pivotant de l'antenne autour de l'axe de l'arbre,

   caractérisé par un second vérin (38), pouvant être commandé à distance, dont les mouvements peuvent être ajoutés aux mouvements provoqués par le premier vérin (34) ou être soustraits de ceux-ci, de sorte que le déplacement angulaire de l'antenne dans son plan de déplacement est la somme des mouvements provenant des deux vérins (34, 38).

2. Antenne selon la revendication 1, dans laquelle le réflecteur d'antenne est orientable en même temps qu'un manchon cylindrique (10, 12) monté en rotation sur un arbre s'étendant entre des tourillons fixés au support.

3. Antenne selon la revendication 2, dans laquelle le manchon comporte des bras qui s'étendent perpendiculairement à l'axe de l'arbre, depuis les extrémités opposées de celui-ci et dans des directions opposées, leurs axes longitudinaux s'étendant dans le même plan.

4. Antenne selon la revendication 2 ou la revendication 3, dans laquelle chaque vérin peut pivoter autour de sa fixation au manchon de façon à permettre les déplacements angulaires du réflecteur d'antenne.

5. Antenne selon l'une quelconque des revendications précédentes, dans laquelle le corps de chaque vérin est saisi par un collier qui est fixé avec faculté de pivotement à l'extrémité respective de son support, une première tige de vérin s'étendant depuis le support d'antenne jusqu'à une première extrémité d'un levier pivotant (22, 24, 26), et l'autre tige de vérin s'étendant depuis une autre extrémité du levier jusqu'à un collier ayant un axe de pivotement quasiment fixe.

6. Antenne selon l'une quelconque des revendications précédentes, comprenant un interrupteur de fin de course associé à un premier vérin, d'où il s'ensuit que lorsque le vérin atteint l'une de ses positions limites, l'interrupteur est actionné afin de provoquer la mise en fonction de l'autre vérin de manière à réaliser le déplacement supplémentaire nécessaire du réflecteur d'antenne.

7. Antenne selon l'une quelconque des revendications précédentes, comportant un élément de montage conçu pour être fixé à un support immobile, et dans laquelle le support d'antenne est mobile autour d'un axe qui s'étend perpendiculairement à l'axe autour duquel l'antenne est mobile.

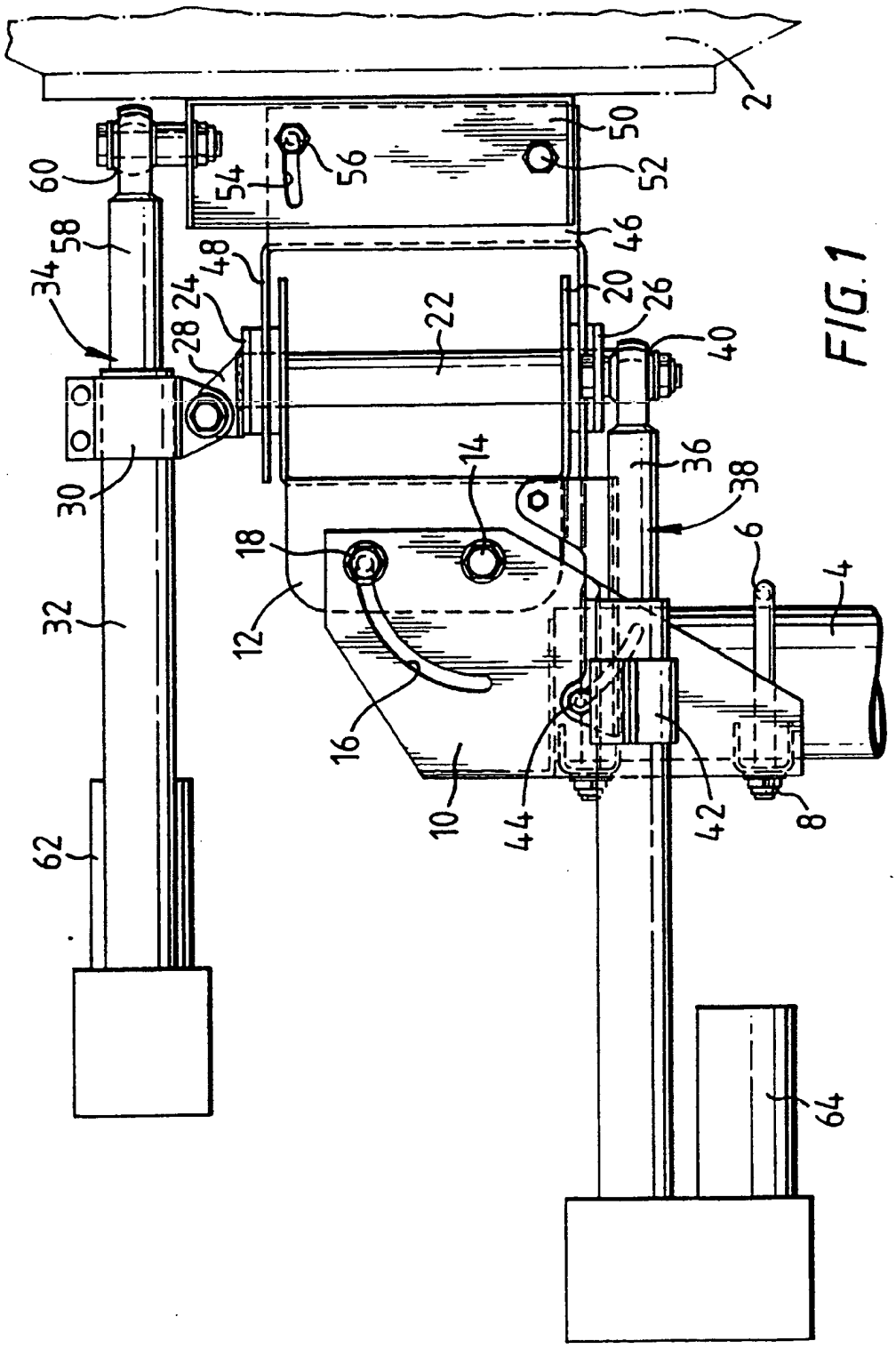

FIG. 1

K 002673

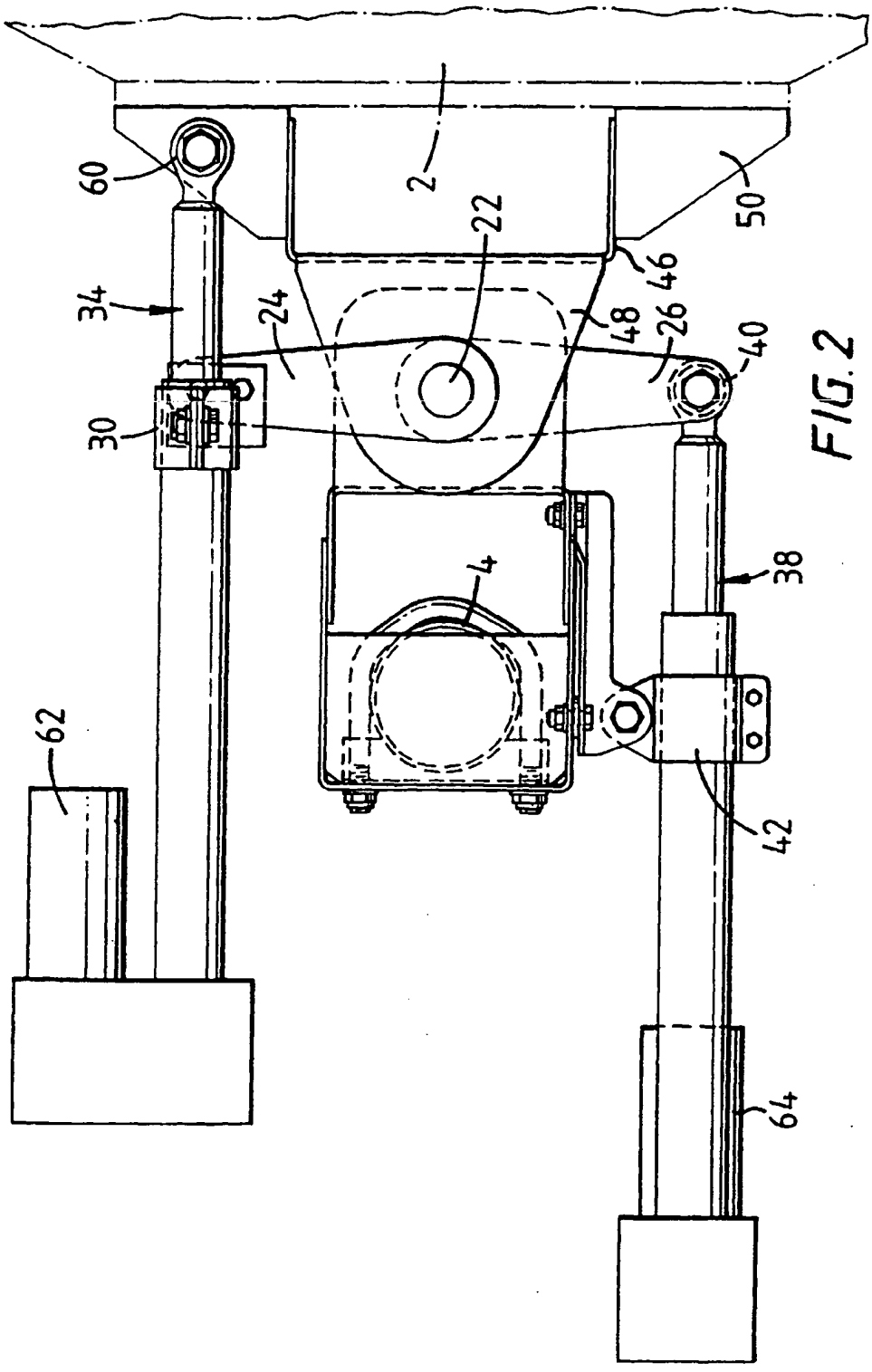

FIG.2

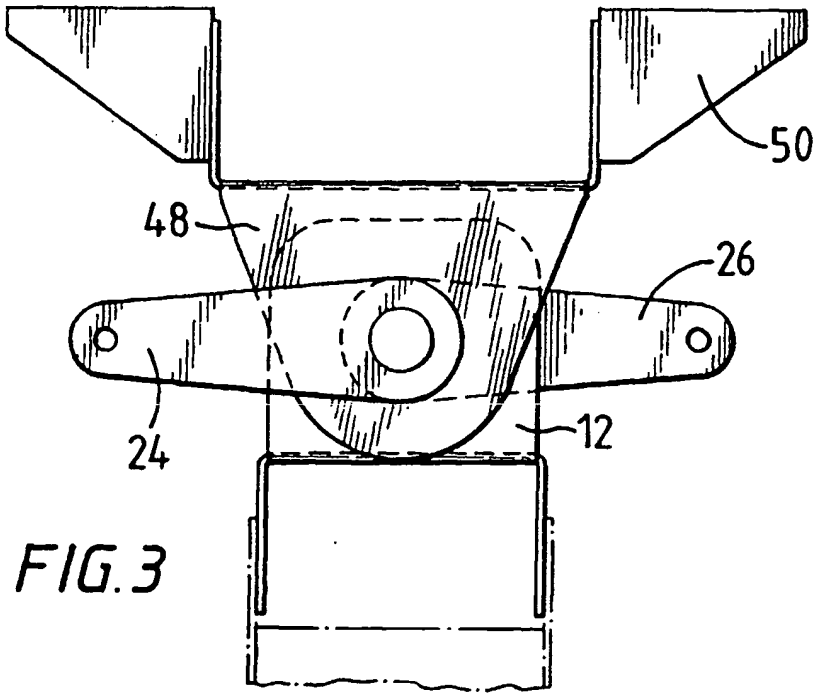

FIG. 3

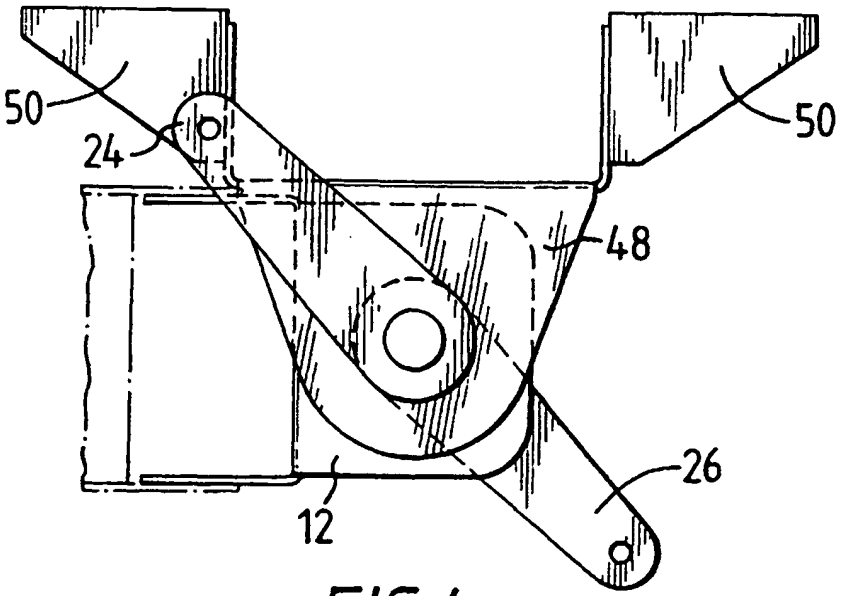

FIG. 4

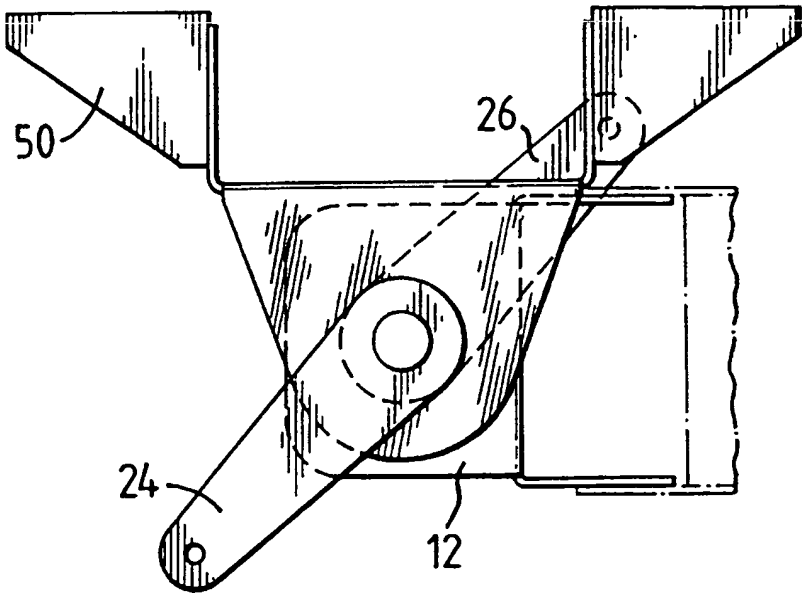

FIG. 5